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Description of Reactor Operating Limits (ROL
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DESCRIPTION OF REACTOR OPERATING LIMITS (ROL)
AND REACTOR MASTER FILE (RMF) REPORTS

Introduction

Following is a detailed description of all the various items contained in the Reactor Operating Limits (ROL) and Reactor Master File (RMF) reports. This was written up as a guide to understanding the reports and to make you aware of the information contained therein. If you have any questions regarding this description, please let me know.

Process Engineering Unit

SA Wood:mhm

REACTOR MASTER FILE

A. Reactor Record - first page of unclassified IBM print out sheets included along with the ROL report.

1. FZ: Flow Zone: Each flow measuring device, such as a venturi, orifice, etc. has been set up as a particular flow zone. These are listed in this section, and defined as follows:

<u>Flow Zone</u>	<u>Flow Measuring Device</u>
01	0.385 venturi with crosswire
02	0.385 venturi with 0.386 thin plate orifice (upstream of venturi)
03	0.302 orifice with cone screen used in a "C" nozzle
07	0.385 venturi with crosswire used on CG-558 nozzle in the ball valve pattern.
09	Off site Pinna meter (used on overbore)
10	0.405 venturi with crosswire (used with Rudock overbore hardware)
12	0.388 captive venturi with crosswire (used with McCarthy overbore hardware)
11	On site Pinna meter
14	0.302 orifice with cone screen used in a "B" nozzle

2. K, E, AND REL: The constants used in the equation for calculating flow rates with each of the above devices is given in this section. The equation can be given in two forms.

$$(a) \quad F = K(\Delta p)^E$$

or $(b) \quad F = K P^E$

where Δp = front header pressure - Panellit pressure

P = front header pressure - front header elevation correction

and K and E are constants in the equation given under those columns in this section. The first equation is the one most often used and is designated by a "D" under the REL column. The other equation is designated by an "H." Thus the equation used for calculating tube flow is as follows:

$$F(\text{gpm}) = K (\text{front header} - \text{Panellit})^E$$

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REACTOR MASTER FILE (continued)

3. OPC: Operating Pressure Constant

SFC: Safety Factor Constant

These two constants are used in calculating the minimum base for either cavitation or low trip protection. The equation for this calculation is as follows:

$$\text{Min. Base} = \text{OPC (FH)} + \text{SFC} - \text{LT}$$

where FH = front header pressure

LT = low trip dial set (= 10 for a 10-90 gauge)

4. X: crossheader number

5. FEC: front header elevation correction; used to correct header pressures from front header elevation to the control room Heise elevation.

6. REC: rear header elevation correction: used to correct rear header pressures as read on the front face gauges attached to the ΔP system to rear header elevation.

7. F: front header pressure (as read)

8. R: rear header pressure (as read)

B. Unit Records

1. Unit: tube number

2. H: header number

3. Z: flow zone

4. LT: low trip dial reading

5. ER: effective range; number of psi between low trip and the maximum allowable dial reading

6. TT: total taps

CT: center taps

ET: end taps

These numbers are used in calculating the pressure drop from the point on the rear header where the rear header pressure is measured to any particular process tube along the header.

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REACTOR MASTER FILE (continued)

7. CI: corrosion index
8. RT: rib type; N represents a normal high rib tube; R is a reduced rib tube.
9. RF: rear fitting type. A "1" denotes a standard rear hardware with just a T/C well; 2 is the hardware using both a T/C and an RTD.
10. PP: previous Panellit pressure; Panellit pressure contained in previous ROL report.
11. CP: current Panellit pressure; Panellit pressure current at the time the ROL was made up.
12. PD: Panellit dial reading on last hot dial map.
13. PB: previous Panellit base pressure; base pressure in previous ROL report.
14. CB: current Panellit base pressure.
15. DATE: date of last time gauge was either Heised or rolled.
16. TIME: time of day for No. 15
17. MBC: method of base calculation; an asterisk in this column indicates that the last base calculation was from rolling data; no asterisk indicates Heise data was used.
18. DPS: tube flow rate
19. UC: tube class; these are defined as follows:
 - AC: air channel
 - GS: graphite stringer
 - ZR: regular size zirconium tube
 - OB: overbore tube
 - SA: solid aluminum charge
 - BM: "B" metal charge
 - TT: traverse tube (horizontal or vertical)
20. LOTP: load type; used to define type and loading order of metal charged.
21. CDA: charge date using HAPO calendar notation.

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REACTOR MASTER FILE (continued)

- 22. PMRH: rear header pressure at tube location plus 15 psi
- 23. PRHE: end-of-active section pressure in the process tube.
- 24. No label - column to right of PRHE: calculated TAI limit - 130

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REACTOR OPERATING LIMITS

1. TUBE - tube number
2. TU CL - tube class
3. FLOW - tube flow rate, gpm
4. PAN PRS - Panellit pressure; same as Heise pressure
5. PAN DIFF - Panellit difference; difference between Panellit (or Heise) pressure between current and previous ROL report. Any tube with a difference equal to or greater than five that was not charged the previous outage should be scheduled for Heising the next outage.
6. BOL LIM - annulus boiling limit (P.S. A-021)
7. TAI LIM - trip-after-instability limit (P.S. A-020)
8. LOW LIM - the lowest of either the ANB or the TAI limit
9. MAX BASE - the maximum permissible Panellit base pressure
10. MIN BASE - the minimum permissible Panellit base pressure
11. TUBE - tube number
12. CURR BASE - current base pressure at time ROL was made up
13. HS SD - Heise after shutdown; an asterisk in this column indicates that the tube should be Heised the next shutdown
14. NEW BASE - new base pressure; to be entered under this column any time a Panellit gauge is rolled and checked against maximum and minimum base limits to insure against rolling a gauge out of base pressure limits. A small square under this heading indicates that the base for that tube is within 10 psi of either maximum or minimum base pressure limits and so extra care should be used to prevent rolling the gauge out of limits.
15. DAT ADJ - date adjusted; date that the gauge was rolled is entered in this column.
16. LIM CODE TAIERLT - limit code; the minimum base pressure given in the ROL can come from either of two sources. The IBM machine calculates both minimum bases, one for cavitation or low trip protection, and the other for TAI limit considerations. The highest base limit of these two is the one printed in the ROL. If the minimum base limit given is the one calculated for TAI limit considerations then an entry is made under the LIM CODE column. The entry made gives the data used in calculating the minimum base and is broken down as follows: the first three numbers is the TAI limit used, the next two numbers is the Effective Range, and the last two is the low trip dial setting. These are used in the standard TAI limit equation which is

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solved for the base pressure. Thus, if the Panellit base pressure is equal to or greater than the minimum base, the TAI limit will be at least equal to the value given in this column.

17. LOAD TYPE - type of metal charge currently in the process tube
18. FLOW FACT - flow factor; equal to 0.2635 times the tube flow; used in calculating tube power with the equation:

$$\text{tube power} = \text{flow factor} (\text{tube } \Delta T)$$

19. TUBE - tube number

In addition to the tube-by-tube listing given above, the section in the back of the ROL also presents useful information.

Page B1: gives a header-by-header listing of:

1. The number of channels per header.
2. The number of process tubes per header.
3. The flow per header obtained from the sum of the tube flows on that header.

Page C1: gives a flow zone listing of:

1. Total number of channels listed under that flow zone.
2. Number of process tubes in a particular flow zone.
3. The total flow of that zone obtained by summing the tube flows in that zone.

Also listed on this page is the total number of tube channels, process tubes, and the total reactor flow.

Page D1: presents a process channel and process tube breakdown by metal load type; also gives the total flow for each load type.

Page E1: gives the total number of tube channels for various tube classes.

Page F1: this page gives a breakdown of the tube flow and Panellit pressure for each load type and flow zone. Especially useful is the average flow and Panellit pressure presented here. This can be used as a comparison point when trying to spot flow or pressure abnormalities. Also given is the total number of tubes for each load type and flow zone.

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